BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
	)	
Revision of Part 15 of the Commission's Rules	)	
Regarding Ultra-Wideband Transmission	)	ET Docket 98-153
Systems	)	

Motorola Comments on Reports

Motorola, Inc. ("Motorola") submits these comments in response to the Federal Communication Commission's ("Commission's") public notice requesting comments on five reports regarding the potential for ultra-wideband (UWB) transmission systems to cause harmful interference to other radio operations.[1] A consistent and overarching theme that emerges from these reports, and numerous other documents that have been submitted into the record of this proceeding, is that the potential for UWB devices to cause interference to a wide variety of services is very real and that the interference mechanism is a complex one that is dependent on the characteristics of both the UWB device and the victim receiver. The studies considered in the public notice provide further support for Motorola's position that UWB presents a significant potential for

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[1] *See* Comments Requested on Reports Addressing Potential Interference from Ultr-Wideband Transmission Systems (ET Docket 98-153), *Public Notice*, DA 01-753, March 26, 2001. The public notice requests comments on a March 5, 2001 report submitted by Qualcomm addressing potential interference to Personal Communications Services (PCS) devices (Qualcomm report) and four reports addressing potential inference to Global Positioning System (GPS) receivers, a report submitted March 9, 2001 by Time Domain Inc. through the University of Texas and John Hopkins University (John Hopkins report), a report submitted March 9, 2001 by the National Telecommunications and Information Administration (NTIA) (NTIA Report), and reports submitted March 21, 2001 and October 30, 2000 by the Department of Transportation through Stanford University (DOT reports).

causing interference unless appropriate limits are adopted to protect communications services operating throughout the spectrum.[2]

Considering the complexity and potentially far reaching impact of this issue, it is important that the Commission proceed cautiously in adopting any rules that would allow deployment of UWB devices in order to ensure that primary services operating in frequency bands under consideration are not disrupted. Motorola supports the comments filed on March 27, 2001 by 26 companies advocating that the Commission publish any proposed rules prior to adoption to provide an opportunity for all parties to understand the impact of, and comment on, such rules.[3]

To assist the Commission in its difficult task of considering rules for UWB devices, Motorola has been conducting simulations that will provide insight into the effect that UWB devices will have on other services in real-world conditions. The simulations consider various UWB deployments and interference into PCS and GPS receivers. These simulations are near completion and will be provided for the record in this proceeding within the next few weeks.

I. The Public Notice

In its March 26, 2001 Public Notice, the Commission requests comment on five reports providing information on the potential for UWB devices to cause interference. Four of the reports consider interference from UWB to GPS, while the fifth report considers interference from UWB to PCS. These reports are just the latest information in the record of this proceeding demonstrating the potential for UWB devices to cause

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[2] *See* Comments of Motorola, Inc., September 12, 2000.

[3] *See* Joint Industry Filing on UWB NPRM (ET Docket 98-153): Need for Further NPRM Prior to Adoption of Final Rule, March 27, 2001.

interference to a variety of services.[4] Thus, while the majority of the reports considered in the instant public notice consider interference from UWB into GPS receivers, it is clear that a substantial record has been developed demonstrating that, absent appropriate emission limits, UWB devices pose a significant threat to communication services in general. While there is a considerable amount of information in the record demonstrating the potential for UWB devices to cause interference, the record is not yet sufficient to come to conclusion on appropriate rules for UWB operation. Accordingly, it is not appropriate to bifurcate the proceeding as proposed by Fantasma Networks, Inc. ("Fantasma") with the Commission adopting rules at this time for authorizing UWB in non-GPS bands.[5]

Given the volume of the reports under consideration and the limited time for comment, it was not possible for Motorola to completely evaluate each report. Accordingly, our remarks are concentrated on the report provided by the NTIA. We note, however, that all of the reports are similar in that they demonstrate that interference from UWB devices is a very real concern and that the interference mechanism is a complex one that is dependent on the UWB technology, the UWB deployment scenario, the characteristics of the victim receiver and receiver deployment. For instance, the report by Johns Hopkins University notes that, "The choices of time coding parameters

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[4] A partial listing of other information includes Motorola's comments of September 12, 2000; test results submitted jointly by Sprint PCS and Time Domain, with analysis by Telcordia Technologies on September 12, 2000 (*See* Dr. Jay Padgett, Senior Research Scientist, Telcordia Technologies, "A Model for Calculating the Effect of UWB Interference on a CDMA PCS System" (Sept. 12, 2000), *as amended* Attachment 1 to the September 12, 2000 Sprint PCS and Time Domain Letters; and a report by NTIA, "Assessment of Compatibility Between Ultrawideband Devices and selected Federal Systems, " NTIA Special Publication 01-43, Docket No. 98-153 (Jan. 2001).

[5] *See* Letter from Henry Goldberg, Attorney for Fantasma, April 2, 2001.

[by UWB] can produce significant differences in the amount and type of performance effect experienced by GPS receivers."[6] Qualcomm notes that, "The proposed introduction of time-domain based UWB technology in the frequency domain poses serious and complex technical issues that are not fully understood."[7] In considering the effect of UWB devices, which operate over a large expanse of spectrum, it is important that the Commission understand the impact on all potentially effected systems prior to allowing operation of UWB. The record in this proceeding is far from complete with regard to numerous systems that would be impacted.

II. The NTIA Report

In February 2001, the NTIA released Special Publication 01-45, "Assessment of Compatibility Between Ultrawideband (UWB) Systems and Global Positioning System (GPS) Receivers". This report describes the results of a two-part study consisting of measurement and analysis components. In the measurement phase, the interference susceptibility of representative GPS receivers to several different UWB waveform types (pulse-like, CW-like, and noise-like) was assessed. Utilizing the measured results, analyses were then performed for five different operational scenarios (terrestrial, maritime navigation, railway, surveying, and aviation) to determine the maximum allowable UWB EIRP levels that can be tolerated by GPS receivers before performance degradation (loss of signal lock, or substantial increase in reacquisition time) is realized.

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[6] John Hopkins report and ES-1.

[7] Qualcomm report at 25.

The voluminous amount of information in the report makes interpretation somewhat difficult. However, Motorola wishes to highlight certain results and conclusions from the study.

a. Importance of Terrestrial Operating Scenario

Motorola believes special emphasis should be placed on the terrestrial operation scenario due to the anticipated crucial role that GPS will play in safety-of-life applications such as Enhanced 911 (E-911), recently mandated by the FCC.[8] To fulfill this mandate, GPS functionality will find its way into many, if not most, cellular and PCS handsets, regardless of the specific air interface employed (CDMA, TDMA, GSM, iDEN, etc.) Moreover, should UWB devices become prevalent their likely operating scenario will be as terrestrial communications devices (e.g., wireless data modems) used in precisely the same environments as E-911.

b. NTIA analytical results for terrestrial case

The NTIA study shows that for the terrestrial operating scenario, the limiting cases are the CW-like and noise-like UWB signal types for the single UWB device scenario. In this scenario, the UWB device is located 2 meters from the victim GPS receiver. Referring to Fig. 3-5 on page 3-31 of the NTIA report, we see that for the CW-like case the maximum allowable EIRP ranges from -104.3 to -106.9 dBW/MHz, depending on the pulse repetition frequency. These levels are 33.0 to 35.6 dB below the current Part 15 limit of -71.3 dBW/MHz. For the noise-like case (Fig. 3-4 on page 3-31),

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[8] *See Revision of the Commission's Rules To Ensure Compatibility with Enhanced 911 Emergency Calling Systems*, Fourth Memorandum Opinion and Order, CC Docket 94-102, released September 8, 2000, FCC 00-326.

the maximum EIRP ranges from -96.6 to -98.6 dBW/MHz (again depending on pulse repetition frequency), or 25.3 to 27.3 dB below the current Part 15 limit.

These results pertain to the "break-lock", rather than reacquisition, criterion for GPS performance degradation. The break-lock criterion appears to be more relevant for the so-called "assisted-GPS" mode of operation, which is the leading approach for embedding GPS functionality in cellular handsets. For conventional GPS receivers the reacquisition criterion may be more appropriate, in which case the maximum EIRP levels should be reduced an additional 6 dB (page ix of the NTIA report).

Based on the above, a prudent course of action would be to consider setting an EIRP limit for UWB devices on the order of 35 dB below the current Part 15 limit for devices that emit a CW-like signal. Alternatively, if the device can be designed to produce a noise-like emission, then the limit may be relaxed to roughly 27 dB below the current limit. We note that many UWB equipment manufacturers and proponents tout the ability to make signals appear noise-like as one of UWB's benefits. Therefore the latter, less stringent limit may be the relevant one in most cases with regard to GPS receivers, however, the Commission must not assume that UWB will be noise like, and should adopt regulations that take into consideration the actual operation of the UWB device.

III. Conclusion

The above recommendation regarding EIRP limits for UWB devices flows from consideration of the impact of UWB devices on GPS receivers. Because interference from UWB depends on the characteristics of the UWB transmitter as well as the characteristics of the victim receiver, whether it's a GPS receiver of a receiver for another service, such as PCS, appropriate limits may vary depending on the UWB device and the frequency band under consideration.

It is clear, however, from the record of this proceeding that UWB has the potential to interfere with a wide variety of radio services and it is important that a complete understanding of the impact that UWB will have is developed prior to any Commission action that would allow wide-spread UWB deployment. To further the Commission's base of knowledge on the realistic impact of UWB deployment, Motorola will be submitting the results of simulations that will provide insight into the effect of various UWB deployments on both PCS and GPS systems. It would be inappropriate for the Commission to act to adopt regulations for UWB until such time as the impact of UWB deployment is fully understood.

Respectfully submitted,
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